CONSCIOUSNESS UNDER ANÆSTHETICS.

By Edmund Jacobson

As yet it has been for the most part left to the surgeons to describe the nature of experiences under anæsthetics. They have worked out a semi-popular psychology, and thereby meet the demands of their practice with such success as a common-sense method can be expected to secure. But sometimes their problem becomes very delicate, and invites the subtlest refinements of scientific consideration,—for what they have to deal with, and what life itself depends upon, is the employment of tests for the presence or absence of psychoneural functions. Now objective tests for consciousness should, when possible, be confirmed with introspections from the subject, and in so important a matter as the present it is desirable that those introspections be as accurate and as detailed as possible. That the psychologists are commencing to assist in this introspective task is shown by the fact that three articles, recounting personal experiences and attempting to make generalizations, have recently appeared in their journals. That many more will be needed is evident; and therefore we add the present report to their number. Certainly the most startling thing we have to describe is that the patient was conscious under the anæsthetic at the very height of the operation.

The case to be cited occurred at Wesley Hospital of Northwestern University in October, 1910, upon the occasion of an operation for the removal of the appendix under the influence of nitrous oxid and air. The anæsthesia lasted sixteeen minutes. With reference to the patient's physical and mental condition at the time, it is important to remark that he had not recently been ill, so that at the outset both physical and mental condition were normal, except in so far as he was stimulated by the serious and novel situation. Hence attention was unusually keen, and the subsequent memories clear and detailed; so, for illustration, the *minutiæ* of the conversation between two of the operators concerning the movements of the meniscus of the sphygmomanometer which they were preparing for use are still, after several months, vividly recallable. It should be added that the patient had previously half jestingly remarked that he might take subjective observations;

for this virtually constituted an *Aufgabe*, and hence was one of the factors which determined his mental attitude toward the experience.[1]

With some abridgment and alteration to suit present purposes, we shall quote from memoranda which were not written down until from four to six weeks after the operation, but which nevertheless are, as we believe, accurate. Here and there we shall interrupt the account with explanatory comments. The experienced reader will readily distinguish the points at which we are unable to give direct descriptions of the psychic processes, and therefore are obliged to substitute impressionistic indications or statements of meaning.

"After I had been placed upon the operating table and while preparations were under way, I remember that I conversed with one of the surgeons, that he inquired whether I was nervous, and that I answered 'No.'

"The time came for the application of the gas. I was told that air would be given first, and then the gas gradually mixed with it, but that I should not be able to detect the latter, since it was odorless. Then the bell was put on, leaving my eyes partially or wholly exposed. My left arm was extended, and rested in the blood pressure apparatus, but the hand grasped the wrist of one of the surgeons, Dr. P. I breathed and waited. Nothing happened for a short time, and I squeezed the wrist to show that I was fully awake. Presently I detected the oncoming of the gas, and I squeezed the wrist again, and silently thought that they were mistaken in saying that the gas had no odor. I breathed in the gas for a little time and worried slightly because it did not seem to affect my consciousness. Then the gas began to operate, and I reacted by squeezing the wrist. There was no sense of suffocation, nor again of giddiness. Objects commenced to slip from the mental grasp, and there was a sort of blurring of those that remained in consciousness. My central thoughts remained perfectly firm. Then came a striking experience. My eyes were open, and though the bell occupied the centre of the visual field, yet it did not obscure the rest of the room. Now gradually the sight began to alter. The outlines of things became blurred, and at the same time the perspective began to disappear, until the field became perfectly flat, and what with the four or five heads of the operators, as they appeared arranged around the bell, the whole (apart from the blurring) looked like a picture of the early Florentine school; though of course I make this comparison now and did not then think

[1]Habits of continual self-observation, also, will have to be taken into account.

of it. A moment later and this also was gone and I saw no more; excepting that very nearly colorless lights danced outward accompanied by a dull buzzing. I said to myself, 'I don't care; I don't care.' This was in some measure true and spontaneous; but also, in part, it came as a deliberate auto-suggestion, and was followed shortly after by a fleeting and half-developed realization that the suggestion was not working negatively.

"At one time, when consciousness was perceptibly affected, the hand of an assistant was pressing heavily, and I muttered a protest; and when some one said 'Keep quiet,' I laughed in a guttural manner to show that I was so. At another time—I do not know precisely when—after vision had gone, the surgeon laid his hand on the body, and I cried out, 'Not yet! I am awake!' Again, after I was no longer able to squeeze the wrist, I tried to show that I was awake by muttering 'um—um' with each expiration. While I was able later to recall that I had squeezed the wrist and had laughed, the facts of having muttered and of having exclaimed that I was awake did not recur to me until I was told of them.

"There were other thoughts during the administration of the anæsthetic which now escape recall. I remember with great clearness, however, the way in which the gas seemed to affect consciousness, for I was deeply interested in it at the time, and described the processes to myself even while they were occurring, though not always in verbal terms. So that finally, when things had almost all fallen away, I said to myself, very, very slowly, 'Dim-in-ish-ing, dim-in-ish-ing con-scious-ness!' That was the last word, and I knew nothing more; but as these words appeared there occurred an intellectual process, which containd no distinct verbal images, and the meaning of which was, 'Your personality must be psychological at its core, if you think of such things at this moment'."

There came a break in consciousness here. The experiences which we are about to describe are more or less disordered and confused. Subsequently, in recalling them, they appear without temporal setting, and as more or less disconnected from the experiences during the waning of consciousness.

"'Are you ready, Doctor?' 'Just a minute, please.'[1]

"Possibly there was a dull whirring and buzzing; voices moved to and fro; my ideas were confused and troubled. I did not rightly know where I was, nor what was happening. One thing stood out clear; there, in the right side,—the pain!

[1]When later I repeated the remark to Mr. B., I learned that it was addressed to the anæsthetist; and therefore it doubtless meant that I should soon be in the state of deep anæsthesia. I was not able of myself to recall when I heard these words.

It was sharp, griping; it seemed to be drawing the whole body to that spot. It was agony. I have never endured, never before even imagined such intense torture. I groaned again and again, in helpless, uncomprehending protest.

"I had many troubled dream experiences, which afterwards I could not recall, yet knew that I had had them. The pain lasted long, long, and around it my dreams centered. Suddenly—I do not know just how suddenly—I realized it all: This agony I cannot escape; I am being operated upon! I am here on the operating table! And I am conscious!

"Conscious! I tried voluntarily to suppress the pain and seemed in some degree to succeed. I stopped groaning.[1] I was thinking now, perhaps with breaks and disordered interruptions, but yet in fair measure logically and coherently. I am under the anæsthetic and I am conscious! It is secondary consciousness! Amnesia will follow. I must try to remember what is happening in order afterwards to relate it and prove that I was conscious. At about this time I spoke aloud to those about me, exclaiming, 'I've made a discovery; I've made a discovery! The secondary consciousness—.' According to my subsequent memory, I said three words more before I stopped without completing the sentence. It seemed as if I had said, 'The secondary consciousness is the primary consciousness—' and I intended to go on and say that the same *I* was present in both, and perhaps to say something else, which I have since forgotten; but I ceased, owing to the difficulty of putting the matter into words and owing to lack of strength.[2]

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[1]In this connection it is interesting to note that Dr. C. reported, 'There was a time when you (the patient) seemed to reconcile yourself to it, and you stopped groaning.' I report this voluntary suppression because I have a memory of it; it is not, however, in accord with my waking experiences, since I am not ordinarily successful in suppressing pain in this way.

[2]Those present state that I never mentioned 'primary consciousness' at all, but that I repeatedly said 'secondary consciousness' in rapid succession. In subsequent conversations with the surgeons I stated that I had used the term 'secondary' not in the usual sense (*i. e.*, of double consciousness), but rather to signify a type separated from primary or waking consciousness by amnesia. I trace the associative source of this idea to reading certain passages in Bramwell a few weeks before, though that author of course observes the customary usage. (Especially p. 390, *Hypnotism*. London, 1906.)

I had never had any anticipation that I should be conscious during the operation. For the sake of completeness a trivial incident may be mentioned in this record; a week before the operation a layman had asked another in my presence whether anæsthetised people ever felt anything and had got the answer, 'No.' The incident passed out of my mind at once and did not recur to me until after the operation, when I tried to recall what remarks about anæsthetics I had recently read or heard. The incident is entirely negligible, I believe, and I mention it only because the record requires.

"'Stop the anæsthetic!' It was probably just a little after this was said that marked changes took place. The griping pain, sharply located in the region about McBurney's point, was giving place to a very mild pain, different in quality and referred to the region about the umbilicus. The latter was quite tolerable, and was the kind of pain which in stronger form remained more or less continuously for about thirty-six hours after the operation. I was 'waking up,' and as audition was present, I commenced to make a series of remarks which ceased when vision began to come back. Most striking was the reappearance of the visual field,—at first like a flat (Florentine) picture, and then gradually regaining perspective and clearness,—just the reverse of the initial experience. It was this that prompted me to say aloud, 'It all ends just as it began!'"[1]

About two minutes after the stopping of the anæsthetic, the patient was fully awake and rational. He entered into conversation about his experiences at once, suggested to the internes not to make the bandages too tight, etc. Though talking was very difficult, this conversation was for a while continued after the patient had been put to bed. Temperature and pulse fairly soon became normal, and recovery was very rapid. The case had no subsequent history, though it may be mentioned that during dozing in subsequent nights, there occurred three local nervous spasms, which were painful and accompanied by slight psychical disturbance.

Excepting where otherwise specified, the report quoted is based upon the memories of the patient, and there is evidence that they are on the whole satisfactorily faithful. In support of this may be mentioned that he repeated to the surgeons that he had laughed and had periodically squeezed the wrist he held; although it came as news to him that eventually the fingers had closed about the wrist with a vise-like grip. At various places in this paper we specify things not recalled at all, and also things recalled only after others had first mentioned them. Most important is it to remind the reader that, while the operation was going on, the patient determined to remember what was happening, in order later to be able to prove that he had been conscious. This was virtually an auto-suggestion to remember, and in the light of current knowledge, we should expect it to have efficacy; for it is well known that the amnesia which characteristically follows deep hypnotic states can be prevented, if suggestion to remember be given while the state is in course; and again, in normal psychology it has been experimentally verified that the intention to remember and to relate psychological experiences has a similar efficacy. (Messer, A. *Experimentell-psychologische Untersuchungen über das Denken. Arch. f. d. ges. Psy.*, 8, 1906, 20. Also, Ach, N. Ueber die Willenstätigkeit und das Denken. Göttingen, 1905, p. 11.) Therefore it is particularly interesting to state that immediately after waking, the patient was able to enter into conversation about "secondary consciousness," "discovery," and the like, without needing to be informed of having spoken aloud of these things. Furthermore, his memory of the question "Are you ready, Doctor?" and the answer "Just a minute, please" was corroborated by Mr. B., who was

[1]This accords with the statement of Hewitt, "When the administration is discontinued and fresh air admitted to the lungs, a kind of retrogression in the patient's symptoms commences." *Anæsthetics and their Administration.* London, 1893, p. 327.

present during the operation. But the most interesting verification of all was the repetition of the groan to Dr. C. and Mr. B., who were able to recognize it without a doubt because of its very peculiar character. It was the kinæsthetic-auditory memory-image of this groan and the auditory image, "Are you ready, Doctor?—Just a minute, please," that the patient found associated with the memory of his conscious determination to remember.

We have some brief notes kindly dictated to us by Dr. G. T. Courtenay and Mr. J. R. Buchbinder, both of whom assisted in the operation, but unfortunately not given until three weeks after the operation and therefore somewhat inaccurate and incomplete. We give them, however, since they are all that we have; for the sake of clearness we have somewhat altered their style.

Dr. C.—Before the incision the patient said, "I am not asleep," again and again. Dr. R. put his hand on the abdomen and he said, "Not yet! I am awake!" He was not thought to be under as yet. He had been muttering. The incision was made. During this time, and up to the moment when the operator came to the appendix, there was no muttering and nothing was said, but there was muscular rigidity. Then the patient cried, "Oh—h!"—groaning. As I remember it, he then cried loudly, "I am awake!" and repeated this several times. While the skin-clips were being put in he exclaimed, "It 's the secondary consciousness! I have made a discovery!" (See also p. 336.)

Mr. B.—While the gas was being given to induce anæsthesia, the patient said nothing. After two minutes Dr. R. said, "Are you ready, Doctor?" (When the writer reminded Mr. B. that the answer came, "Just a minute, please," he recalled the remark and supplied the information that it was addressed to the anæsthetist.) Before the incision there occurred inarticulate muttering. Probably during or after the incision (I cannot positively say which) the patient said, "I am conscious." A minute or two elapsed, during which the operator was getting the tip of the appendix and the patient was quiet. While the cæcum was being manipulated he said, "I have made a discovery;—an important psychological discovery!" This was repeated many times, each one faster than before. The appendix was cut off and the patient squeezed the wrist of Dr. P. with a very strong grip. Then he repeated "important discovery" and "secondary consciousness" a few times. (It will be recalled that the report of the patient shows no remembrance of the phrases having been thus repeated. In this respect Mr. B.'s report supplements the former, and is without question correct; but we doubt that the terms "important" and "psychological" were used.) After the first skin-clip had been put on, the administration of the anæsthetic was stopped and the suggestion given, "You can wake up." During the last few minutes the patient was quiet, and after waking said to me, "I've made some interesting observations. Did you take notes?" (Mr. B. amended the above account after the patient purposely repeated the groan for him. Like Dr. C., he was able to recall with certainty that it occurred, but unlike him, was not perfectly sure when it occurred, adding, however, that the balance of probability seemed in favor of its having occurred after incision.) During the operation the blood-pressure, as indicated by the sphygmomanometer, remained constant.

Now let us proceed to general matters.—It is more or less the custom, in treatises on anæsthesia, to include an account of the order of disappearance of the functions of the nervous system. So, for instance, Patton says, "There is irritation, depression, and finally paralysis of the nervous system. The cerebral cortex, the cerebellum and ganglia of the base, the

sensory tracts and centres of the cord, the cerebrospinal motor tracts and centres, and the respiratory and cardiac centres seem to be affected in the order mentioned."[1] Experimental and clinical observations have led to formulæ of this sort, which therefore must have at least a certain rough validity. Everyday clinical experience makes it familiar that circulation and respiration almost always remain when other functions have failed; and it is equally certain that the loss of the conjunctival reflex is a useful indication of the loss of various other nervous functions. There are other gross correlations of this sort, the validity of which is fairly beyond challenge. The principle of such correlations is, therefore, true and useful—if not carried to the extreme. But the current formula that the nervous functions disappear in hierarchical order cannot, we believe, be completely relied upon. It appears that sometimes, at least, a higher function may remain even when certain lower ones have gone; that the absence of certain lower functions is not an invariable guarantee of the absence of all higher ones. In evidence of this may be adduced our own case as a fair example of the highest psychoneural function, namely intellection, remaining present even when lower ones such as vision were in abeyance. Nor does this observation seem to be exceptional, for the same thing is reported, with respect to the period of the waning of consciousness, not alone in the psychological papers of Jones, Johnston, and Hill, but also in Hare's article in *Keen's Surgery*[2]. Therefore we seem warranted in generalizing, at least with respect to persons who make habitual use of the higher intellectual functions, that *generally these persist even after vision and other psychical and physiological lower functions have gone.*

As to the psychological situation, there seem to be some strange misunderstandings (or else carelessnesses) in certain

[1]Patton, J. M.: "Anæsthesia and Anæsthetics." Chicago, 1905, p. 30.

[2]"After all sensations were damped down completely there still remained an inner consciousness which for the most part was perfectly normal. Memory seemed pretty accurate, and the reasoning powers only slightly deficient." Jones, E. E. The Waning of Consciousness under Chloroform. *Psy. Rev.* 16, 1909, 53-54. "The special sense organs become inactive long before general consciousness is lost." (Speaking of the process of recovery of normal consciousness, the same writer says, "Feeling is first reinstated. Purely intellectual activity—is next in order." Johnston, H. J. The Rôle of Sensations and Feelings under Ether. *Jour. Abn. Psy.* 4, 1909, 29. "—there —remained to the final fading out of conscious experience an awareness of personal identity." Hill, Prof. and Mrs. D. S. Loss and Recovery of Consciousness under Anæsthesia. *Psy. Bull., 7, 3, 81,* "—chloroform, after a brief quickening of the pulse and of respiration, causes a gradual decrease in the activity of the perceptive portions of the cerebrum, followed or accompanied by a similar obtunding of the intellectual activities." Hare, H. A. *Keen's Surgery,* Philadelphia, 1909, V, 1019. Similarly in the case of ether, 1027.

of the surgical works. For example, in speaking of the second degree of general anæsthesia, Patton states that it is a "stage of unconscious reflex activity."[1] Here, as he says, he is following Hewitt, and therefore we shall quote the views of that writer.[2] "Second Degree or Stage.—(Ether) Loss of consciousness takes place abruptly. The patient passes into a condition in which, although memory, volition, and intelligence are abrogated, he will readily respond to stimuli. The response may have all the appearance of conscious response. (N. B!) Questions may be answered; but the answers will be nonsensical."

If we understand the above passage rightly, it means that a time comes at which the patient is to be considered unconscious, yet at which he will give answers to questions as well as *simulate* conscious response in other ways. This view is so naïve that the psychological reader will not demand that we argue the matter. Hewitt also says, "Laughing, struggling, shouting and singing may be met with at the commencement of this stage if the administration be slowly conducted." We scarcely believe that he wishes to consider these reactions also as unconscious. But without making assumptions in this regard, we may state in reply that, by virtue of analogy with our general psychological experience, there need be no doubt that the patient is conscious when such things occur as answering questions, shouting, singing, talking, laughing, or true groaning.[3] It is absurd to call a stage which may be characterized by the presence of such reactions one of "unconscious reflex activity." Such a use of the term "unconscious" is lamentable, for it contains the confusion, sometimes popularly made, between absence of intelligent response and absence of conscious response.[4]

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[1] *Op. cit.*, 33.

[2] *Op. cit.*, 153.

[3] We use the expression *true* groaning in order to exclude stertor and also expiratory noises due merely to obclusion of the air and vocal passages by tongue, mucus, or other foreign substance.

[4] When a reaction is nonsensical, this indicates the presence of disorganization in consciousness; the processes do not function as usual, relatively to each other. Complete nonsense would mean utter disorganization of conscious processes, but it would be incorrect to take it to mean complete absence of conscious process. This fact being clear, there is left an inviting problem for investigation by psycho-analysis as to whether the utterances of patients under ether or chloroform delirium have not a "latent meaning" under their apparent absurdity. Apropos of this, the writer recalls the deep significance possessed by his groan. It meant uncomprehending and helpless protest against the pain. Physiologically it was the development or consummation of the process of uttering "um—um," for it was made with the same laryngeal adjustment, except that instead of an almost constant pitch it had a large rise and fall, was much higher, and much more prolonged. The former utterance had the meaning "Not yet! I am awake!"

In the light of these considerations, and if even highly organized consciousness has the tenacity which we have indicated, it is apparent how great ought to be the caution in judging that the patient is unconscious on the ground that certain reflexes are absent and notwithstanding that other ones are present. To be sure, with sufficiently deep *ether* or *chloroform* anæsthesia, a condition may be attained which is suggestive of natural sleep; respiration and circulation are the chief visible activities that remain; there is quiet (except for stertor) and relaxation, and the spinal reflexes are largely absent and inelicitable. When things are so, it seems reasonable enough, on grounds that we shall formulate later on, to assume unconsciousness; for although this conclusion cannot be proved with absolute certainty, yet at any rate it has high probability.[1] But there are statements in the surgical books which go farther and assume the absence of consciousness even when such quiet and absence of function are not attained. So, for example, the *International Text-Book of Surgery*, in arguing for a sparing use of ether in prolonged operations, says: "A few whiffs of ether now and again will keep him free from pain, anxiety and fright. As he knows little or nothing, a moderate amount of involuntary struggling unattended with suffering does no harm."[2] We submit, however, that it is not safe generally to affirm that when a "moderate amount of involuntary struggling" is present the patient nevertheless "knows little or nothing." It is a very delicate matter indeed to say when struggling occurs unaccompanied by the conscious functioning of the higher nerve-centres. For if, on the one hand, it is fairly certain that such functions as answering questions are always accompanied by higher consciousness, while, on the other, it is also fairly certain that such functions as circulation are accompanied at most by only a very low form of consciousness, yet the most that it seems fair to concede with regard to struggling is that it can upon occasion belong to either class of experiences. Why this is so will be made clear in the following paragraph.

Jactitation is a phenomenon likely to occur when nitrous oxid is given without oxygen or air and is described, for example, by Luke, as consisting of "clonic muscular contractions commencing in the orbicularis palpebrarum and extending to the limbs."[3] If, as a test case, one is looking for reasons why

[1]In judging depth of anæsthesia the surgeon is guided by observation of some or all of the following: the respiration, the occurrence of swallowing movements, the lid-reflex, the state of the eye and pupil, the pulse, the color of the face and lips, the rigidity of the skeletal muscles (Hewitt).

[2]Phil., I, 1902, 448.

[3]*Guide to Anæsthetics*, Phil., 1906, 19.

this activity should be considered unconscious or conscious, the important fact must be noted that under normal conditions it cannot be consciously initiated (at any rate not in the absence of a preliminary learning process). By analogy with normal experience, therefore, there is no compulsion to assume that jactitation is a conscious phenemenon. And in general it may be said that *there is no logical requirement to assume consciousness in case of activities which under normal conditions are incapable of conscious initiation.*[1] Again, if one is considering another class of functions, those, namely, of the autonomic nervous system,—circulation, respiration, secretion, etc., what needs to be taken into account is that under normal conditions these do not require the attendance of consciousness in order that they may go on. By analogy with normal experience, therefore, there is also no compulsion to assume that these phenomena under anæsthesia are accompanied by consciousness. Or, to put this matter also generally, *there is no logical requirement to assume consciousness in case of activities which under normal conditions may go on without conscious attendance.* It is now clear why it is permissible to assume that deep states of ether and chloroform narcosis are probably unconscious; for all the activities that are observably present in these states are either such as may under normal conditions go on without conscious attendance or else such as are normally incapable of conscious initiation. On the other hand, the phenomenon of struggling does not fall into either of these two categories; for under normal conditions it can be consciously initiated and it never occurs without conscious attendance. Therefore there is an element of hazard in calling it unconscious at any particular time; and at all events, when it occurs concomitantly with shouting, true groaning, or the like, it should—like these reactions themselves—be regarded as conscious.

The mere fact that the patient is subsequently without memory of his reactions must not be assumed to prove that consciousness was absent. For his psychophysiological state is so disturbed—not alone during the administration of the anæsthetic, but also usually for some time thereafter—that memory may be expected to be deficient. So it is in the case of Hill, whose record shows that there was a period following the first signs of awakening during which he did such conscious things as calling for air and chattering more or less irrationally about his experiences, but of which he subsequently had no recollection.[2] The fact of forgetfulness was noted by Buxton in his discussion of chloroform narcosis.

[1] *I. e.*, voluntary initiation.
[2] *Op. cit.*, p. 79.

"In the second stage [Buxton recognized five stages] the mental powers are impaired although not suspended. . . . As a rule struggles or experiences of pain which show themselves at the time are not subsequently remembered."[1] A further reason for presuming that experiences during gas, ether, or chloroform narcosis might not be subsequently recalled, even if conscious at the time, is that amnesia characterizes kindred psychophysiological states, namely deep hypnosis, deep alcoholic intoxication, and the dream states of natural sleep. This tendency toward amnesia, which we must therefore recognize, is an obvious hindrance to proving that the patient was unconscious. One must give him a fair chance to remember: Follow the example of the workers on deep hypnosis: experimentally produce a state of ether narcosis in which involuntary struggling, groaning, and the like occur; during this state or previous to it, get *en rapport* with the patient and suggest to him that he will remember all that occurs; next, quickly bring him back to normal consciousness, avoiding post-anæsthetic disturbance as much as possible, and learn whether the patient then retains any memory![2] If he does not, this is evidence that he had no high form of consciousness; not an absolutely conclusive test, however, since a low or disorganized state of consciousness might be present and yet fail to respond to suggestion. But at any rate, in the absence of experimental tests of this kind, it is a risky hypothesis to assume that such things as struggling and groaning in anæsthesia are other than what they are in normal activity, namely, signs of unpleasant consciousness.

In this connection, attention may be called to the fact (recognized, for instance, by Hewitt) that nitrous oxid does not give that complete freedom from reflex movement and phonation which characterizes the third degree of ether or chloroform anæsthesia.[3] Or again, as A. D. Bevan recently put it,—"(Nitrous oxid) anæsthesia is not as profound as that of ether or chloroform, and the occasional talking of the patient may be disconcerting to one not familiar with the method."[4]

[1]Buxton, D. W.: *Anæsthetics*, London, 1888, 69.

[2]Anæsthetics characteristically produce a state of heightened suggestibility. So in clinical work it is found advisable not do do anything to or say anything before the patient during the waning of consciousness that might act as a harmful suggestion. The close relationship which anæsthetic narcosis bears to such a state of heightened suggestibility as hypnosis is shown on the one hand by the fact that chloroform, for instance, may be used as a decided aid to suggestion in inducing hypnosis (*e. g.*, Bramwell, *op. cit.*, p. 45), and on the other hand by the fact that suggestion may be used as a decided aid to chloroform in inducing surgical anæsthesia (*e. g.*, Munro, H. S. *Influence of Suggestion as an Adjunct in the Administration of Anæsthetics. St. Louis Med. Rev.*, Nov., 1908.)

[3]*Op. cit., p.* 110.

[4]*Jour. Am. Med. Ass.*, 1907, 49, 3, 197.

What seems to us the probable significance of the presence of such reactions has already been sufficiently indicated. Talking does not possess the distinguishing marks that belong to activities which may permissibly be considered as unconscious; for under normal conditions it is capable of conscious initiation and it never occurs without conscious attendance. Therefore the conclusion that it is unconscious when it occurs during anæsthesia is unwarranted. If nitrous oxid anæsthesia is characterized by the presence of such reactions, it does not seem warranted to believe it to be a state of continuous unconsciousness. Nor, as previously indicated, should the assumption of unconsciousness be made with regard to chloroform or ether anæsthesia unless these drugs be given in sufficient quantity to suppress "involuntary struggling" and the like.

It goes without saying, however, that the psychologist can have no opinion on questions concerning the choice of an anæsthetic for a given operation, or again, concerning the advisability of permitting slight consciousness in prolonged operations in preference to running the dangers of exhaustion and collapse which prolonged and deep anæthesia involves. Matters of practice concern only the surgeon. The sole interest of the psychologist is to analyze the mental situation.

Before closing the paper, a few words of discussion may be added in regard to the psychological articles that have recently appeared. Jones presents the record of three experiences under chloroform, two of which were produced for observational purposes alone, and with the aid of simple laboratory devices. His account is therefore more full than could otherwise be the case, and is important because of its qualitative descriptions of sensory processes and its tests as to the order of disappearance of mental functions. That order was: hearing, touch, gross muscular movement, highly specialized movement (fingers), vision, reasoning, memory. To be sure, Jones fails to state whether this order was precisely maintained in all three cases, and one is frequently at a loss to know whether a given phenomenon that he describes occurred in only one of his experiences or in all three. It is to be regretted that he made the methodological error of failing to be clear and full as to what were their similarities and differences. Hill is especially interested in marking the similarities and differences between his experiences and those of Jones. If we have not misunderstood the latter's paper, he was awake—able to reason, and remember—after muscular control had disappeared.[1] If so, then Hill scarcely seems justified in saying that "the

[1] *Op. cit.*, p. 53-4.

persistence of motor ability in the observation of both Jones and myself as witnessed in the waning of consciousness attests its fundamental position, and also that artificial sleep as well as natural sleep. . . is most closely related to the cessation of voluntary motor ability." If one is seeking a key to the explanation of sleep, and regards 'persistence' as the road to finding it, why select 'voluntary motor ability' in preference, say, to voluntary memory,—which in Jones' case was the more persistent? It is relevant to mention the case of the patient described by Johnson, who becomes awake (to the extent of having various sensations and feelings) at a time when the limbs were not under control.[1] To be sure, if voluntary motor ability is absent, one would *ipso facto* not expect normal consciousness to be present. But if anything further than this is to be established, and if voluntary motor ability is to be exalted over its brother functions, a wider range of evidence should be offered than that given by Hill.

Johnson's paper is valuable—among other things—for its description of the waning of voluntary inhibitory power, wherein it resembles that of Hill, but differs from that of Jones and our own since the loss is not reported by the latter two. The order of disappearance of functions, also, differs from that of Jones: vision went before touch.[2] Johnson terminates his paper with a discussion of the nature of feelings, imageless activity, and the like; but these are general matters, better left for laboratory investigation. Efforts should be focused on the attempt to understand the anæsthetic experience itself, with special endeavor to describe minutely the conscious events in their temporal order, and in addition, when possible, to state the physiological concomitants.[3]

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[1] *Op. cit.*, p. 23.

[2] This suggests the matter of individual differences, which vary greatly with (1) the anæsthetic used, and (2) the temporary and permanent psychophysiological conditions of the patient. An adequate account of individual differences cannot yet be written, although the surgical books furnish some material. Of particular practical importance would it be to determine how frequently the pain sense persists during the second and third stages.

[3] An excellent list of problems has been published by Jastrow. *Am. Med.*, Philadelphia, 1905, X, 202. Same also in *Pacific M. J.*, San Francisco, 1906, XLIX, 140.